use of the recalculated value of $(\Delta E)_{Av}$, which is taken to be four times as great for He^+ as for H, in the equation

$$E_{S\frac{1}{2}} - E_{P\frac{1}{2}} = \frac{8e^2}{3\pi\hbar c} Ry \frac{Z^4}{n^3}\left[\ln\frac{mc^2}{(\Delta E)_{Av}} - \ln 2 + \tfrac{1}{2}\right].$$

The effect of the nuclear charge of two in ionized helium a shift 13 times that of hydrogen. A shift of 16 times the observed shift in hydrogen would be 0.540 cm^{-1}.

This work was performed under the helpful direction of Professor F. A. Jenkins. The writer wishes to thank Professor H. E. White for many valuable suggestions, and Mr. Richard Weiss, who was a co-worker in the beginning of the experiment.

[1] G. R. Fowles, Phys. Rev. **73**, 639 (1948).
[2] W. E. Lamb, Jr. and R. C. Retherford, Phys. Rev. **72**, 241 (1947).
[3] Report on Conference at Pocono Manor, Pennsylvania, April, 1948: Notes taken by J. Wheeler.

Conductivity Pulses in Liquid Argon

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June 7, 1948

THE recent interest in the topic of crystal counters has prompted us to attempt a similar experiment with insulating liquids instead of crystals, in order to investigate whether, in such liquids, ionizing radiations excite electrons into conduction levels in which the electrons can move rapidly in an applied field. The purpose of this preliminary communication is to report that we have observed conductivity pulses due to polonium alpha-particles in liquid argon. No such effect was obtained in liquid nitrogen or in *n*-heptane at room temperature.

The counter tube contained two plane parallel platinum electrodes about 5 mm in diameter and 1 mm apart. A solution of radium *D* and polonium was evaporated on one electrode. Either electrode could be connected to an amplifier and the other electrode to a source of positive or negative high voltage. With collecting fields of 1000–10,000 volts/cm, pulses due to the polonium alpha-particles were observed on an oscilloscope screen when the radioactive electrode was negative with respect to the other electrode. There were no pulses in the absence of the radioactivity.

Quantitative observations of the counting efficiency or pulse size have not yet been made. Qualitatively, the number of pulses from a sample in liquid argon appeared to be the same as the number observed when the radioactive sample was mounted in an argon gas ionization chamber and to correspond to the β-activity of the sample. The pulses were not of uniform size. The pulse size increased as the collecting voltage was raised to 5000 volts/cm, but not markedly thereafter. Even at fields of 10,000 volts/cm, they were only about half the size of the pulses in a gas counter of comparable capacity. The collection time of the pulses was no greater than 12 μsec, the rise time of the amplifier used, implying that the electron mobility is not less than 4 cm/sec/volt. With 1000 volts across plane electrodes about 1 cm apart, pulses were not observed in liquid argon.

When the liquid argon was cooled and solidified, presumably in a polycrystalline condition, conductivity pulses were still observed.

When the radioactive electrode was positive, about one-tenth as many pulses of a size about a fourth the maximum pulse size were observed. We suspect that these do not correspond to the migration of positive holes, but were due to *RaE* β-particles that spent a major fraction of their range in the liquid argon.

Pulses were not observed in liquid nitrogen even when deoxidized by a recommended technique.[1] About 5 mole percent nitrogen dissolved in liquid argon did not affect the number or the size of the pulses. A concentration of oxygen of 0.7 percent in argon completely quenched the pulses; at an oxygen concentration of 0.2 percent, the number and the size of the pulses each decreased by about 50 percent. Passage of the tank argon through a deoxidizer did not improve its counting characteristics.

The *n*-heptane was Phillips "pure" grade[2] that was treated with sulfuric zcid and molten sodium to remove any electron trapping impurities.

It is pertinent to recall that Ogg has reported experiments supporting the idea of conduction levels for electrons in liquid ammonia.[3]

More extensive and precise studies of the behavior of electrons in liquid media are planned. From a practical point of view, it would be desirable to search for liquids that will count at room temperature.

An advantage of a liquid counter over a crystal counter would be the absence of space charge accumulation.

This work has been supported by the Office of Naval Research. Mr. Alvin Tollestrup and Mr. J. M. Miller have given us helpful advice about electronic equipment.

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Characterization of Tc Activities Produced by Deuteron Bombardment of Separated Mo Isotopes*

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May 26, 1948

IN a previous letter [Phys. Rev. **73**, 1470 (1948)] a preliminary report was given on a number of short-lived element 43 (Tc) activities produced by the irradiation of the separated Mo isotopes with *ca.* 16 Mev deuterons. At this time, it is possible to communicate further informa-